REMARKS

In section 9 of the Office Action, the Examiner rejected claims 60-62, 64, and 65 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah in view of Brink.

Independent claim 60 - Khayrallah fails to disclose generating a reliability factor based upon a difference between at least two decoded received signal values such that the reliability factor is a measure of reliability of decoding.

Khayrallah discusses an error term. However, this error term is unrelated to decoding reliability and instead is merely a measure of the difference between the channel through which the symbol was transmitted and the equalizer's representation of that channel.

Specifically, the Examiner points to column 7, lines 3-12 and lines 57-64 for a disclosure of the reliability factor recited in independent claim 60.

Column 7, lines 3-12 state that (i) re-encoded, decoded symbols are used from a first pass for calculation of an error term, (ii) the error term is used to update the channel estimate during a second pass, and (iii) a channel tracker 50 more accurately tracks changes in the channel response of the channel corresponding to the received signal.

The Examiner apparently equates Khayrallah's error term with the reliability factor of independent claim 60. However, Khayrallah's error term is the difference between the symbol as received and the equalized, decoded, and re-encoded symbol. As such, this error term is a difference between two decoded values. Moreover, it is merely a measure of the difference between the channel through which the symbol was transmitted and the equalizer's representation of that channel. Accordingly, Khayrallah's error term is unrelated to decoding accuracy and is used to adjust the tap weights of the equalizer in a manner so that the equalizer more accurately reflects the actual channel.

Column 7, lines 57-64 state that (i) the output of the mode selector 56 is provided to the adaptive propagation characterization estimator 32, (ii) the mode selector 56 is provided with the decoded and re-encoded symbols, and (iii) these symbols correspond to the estimates of encoded information from the received signals after processing through the decoder 58 which are associated with particular portions of a received slot.

The reason that the decoded symbols are re-encoded is so that the encoded symbols in the received signal are compared with encoded symbols rather than with

decoded symbols in forming the error between the actual channel and the channel estimated by the equalizer 54.

The output of the equalizer 54 could have been used for this purpose because symbols are in the output of the equalizer 54. However, because the decoder 58 is an error correcting decoder, the output of the decoder 58 is a more accurate representation of the transmitted bits, which, when re-encoded, will produce a better channel error term when compared to the received symbols.

As can be seen, the channel error indicates how well the equalizer 54 is equalizing, not how well the decoder 58 is decoding.

Moreover, Khayrallah's error term is not formed based on two values produced by the decoder 58. Instead, Khayrallah's error term is formed based on one value produced by the decoder 58 and one received value, i.e., a value not produced by the decoder, at the input of the equalizer 54.

Accordingly, Khayrallah does not disclose the reliability factor of independent claim 60.

<u>Brink</u> also fails to disclose generating a reliability factor based upon a difference between at least two of the received signal values, wherein the

reliability factor is a measure of reliability of the decoding.

Brink mentions a bit error rate but does not disclose the way in which the bit error rate is determined, and does not disclose that bit errors are based upon a difference between at least two decoded received signal values.

Brink also mentions producing soft reliability values that are improved during decoding. However, these are bits, not reliability factors.

Brink further states that soft decision values provide information on the reliability of the hard decision values. Specifically, Brink mentions in column 5, line 59 to column 6, line 4 that the soft value for a bit of a symbol is based on the L-value of that bit, and that the absolute value of the L-value denotes the reliability of the bit decision. Brink also states that the full term of the L-value calculation for the bit consists of an additive "a priori" L-value for that bit and a fractional term in which the a priori L-values of the other bits of the symbol are included. Thus, it can be seen that this bit decision reliability calculation is not based upon a difference between at least two received signal values.

Therefore, like Khayrallah, Brink fails to disclose generating a reliability factor based upon a difference between at least two of the received signal values, wherein the reliability factor is a measure of reliability of the decoding.

In section 3 of the Office Action, the Examiner additionally points to column 7, lines 50-54 of Khayrallah. This portion of Khayrallah states that the output of the symbol estimator 54 is provided to a mode selector 56 and to an error correction decoder 58, that the output of the decoder 58 provides decoded symbols which are re-encoded and fed back to the propagation characterization estimator 32.

As applicants explained above, the reason that the decoded symbols are re-encoded is so that the encoded symbols on either side of the equalizer 54 are compared to form the error between the actual channel and the channel estimated by the equalizer 54. The output of the equalizer 54 could have been used for this purpose. However, because the decoder 58 produces more accurate representations of the transmitted bits, use of the re-encoded decoded bits produces a more accurate channel error when compared to the received symbols.

As can be seen, the channel error is not the difference between two decoder values and merely indicates how well the equalizer 54 is equalizing, not how well the decoder 58 is decoding.

In section 3 of the Office Action, the Examiner alludes to a similarity between the way in which the channel error is formed in Khayrallah and applicants' Figure 3. This allusion is an illusion. Khayrallah forms an error by comparing symbols on each side of the equalizer. By contrast, applicants form an error by comparing symbols on each side of the decoder. And it is not even this error that is the reliability factor. So, the similarity alluded to by the Examiner is not meaningful.

In section 3 of the Office Action, the Examiner argues that the received signal values discussed in column 2, lines 24, 25, 62, and 63 and the received symbols discussed in column 3, lines 9 and 10 are the basis in Brink for calculating a reliability factor.

However, these portions of Brink merely state that soft reliability output values are usually more accurate than the soft-in reliability values since they are improved during the decoding process, that N bits are grouped together at the transmitter to form one "mapped

symbol," and that the hard decision demapping associates the incoming symbol with the closest signal point in the signal space (signal point with minimum Euclidean distance in real or complex signal space).

As can be seen, there is no suggestion here of generating a decoding reliability factor based upon a difference between at least two decoded signal values. The demapping in Brink is not germane. During mapping, a number of bits is mapped to a symbol. For example, in digital television that uses trellis encoding, three bits are mapped to one of eight symbols, -7, -5, -3, -1, +1, +3, +5, and +7, since three bits can produce at most eight different symbols.

During demapping, the closest distance between the received symbol and each of the theoretically possible eight symbols -7, -5, -3, -1, +1, +3, +5, and +7 is determined, and that closest one of the eight symbols -7, -5, -3, -1, +1, +3, +5, and +7 is taken as the received symbol. Thus, if the received symbol is +3.2 where the .2 is due to noise in the channel, then the received symbol is determined to be 3 and is demapped to bits 101.

As can be seen, demapping does not suggest the decoding reliability factor of independent claim 60.

For these reasons, independent claim 60 is not unpatentable over Khayrallah in view of Brink.

Because independent claim 60 is not unpatentable over Khayrallah in view of Brink, claims 61, 62, 64, and 65 *per force* are not unpatentable over Khayrallah in view of Brink.

In section 10 of the Office Action, the Examiner rejected claim 60 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah in view of Chung.

As discussed above, Khayrallah fails to disclose generating a reliability factor based upon a difference between at least two of the received signal values such that the reliability factor is a measure of reliability of the decoding.

Chung describes a reliability measure that is in the form of a log-likelihood ratio L(u) for a decoded bit. The log-likelihood ratio L(u) for a decoded bit u is given as

$$L(u) = u\sum_{i=0}^{d}\Delta^{i}$$

where d is the distance from the current node in the decoder, and Δ is given as

$$\Delta = \log \frac{P(correct)}{1 - P(correct)} .$$

P(correct) is the probability of the survivor path in the decoder and is given as

$$P(correct) = \frac{P(path1)}{P(path1) + P(path2)}$$

where P(pathm) is the probability of path m in the decoder.

As can be seen, the reliability measure in Chung is not based upon a difference between at least two received signal values derived by decoding a code vector into a set of received signal values corresponding to the code vector.

Therefore, like Khayrallah, Chung fails to the disclose a reliability factor based upon a difference between at least two received signal values derived by decoding a code vector into a set of received signal values corresponding to the code vector.

In section 4 of the Office Action, the Examiner re-asserts that Khayrallah shows generating a reliability factor based upon a difference between at least two received signal values derived by decoding a code vector

into a set of received signal values corresponding to the code vector.

However, as pointed out above, the Examiner's assertion is not correct.

Because Khayrallah and Chung both do not disclose the reliability factor of independent claim 60, Khayrallah and Chung would not have led the person of ordinary skill in the art to the invention of independent claim 60.

For this reason, independent claim 60 is not unpatentable over Khayrallah in view of Chung.

In section 11 of the Office Action, the Examiner rejected claim 66 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Weng.

Gosse fails to disclose reliance on a reliability factor that is a measure of decoding reliability. According to Gosse, the stopping rule 70 measures channel quality. Thus, Gosse directly contradicts the Examiner.

Moreover, the stopping rule 70 measures this channel quality by comparing the output of the equalizer 40 to a reference provided as the re-encoded output of the decoder 56. Thus, the decoded (and re-encoded) signal value is the threshold, the decoded (and re-

encoded) signal value is not compared to a threshold as required by independent claim 66, and only an equalized signal value rather than a decoded signal value is compared to a threshold.

Weng does not disclose a reliability factor that is a measure of reliability of the decoding. Instead, Weng states that corrupted code words c(j) have associated therewith reliabilities r(j) which are generated by a channel processor not disclosed in Weng. Thus, each value j in the code word c(j) has a corresponding reliability value j in the reliabilities r(j).

The decoder 32 produces a bit error pattern b(e) which indicates which of the values j in the code word c(j) are corrupted.

The values r(j) along with the error pattern bits b(e) are fed to an error pattern reliability computation circuit 34. The error pattern reliability computation circuit 34 adds the reliability values corresponding to those values in the bit error pattern b(e) that are 1, i.e., corresponding to those values j in the code word c(j) that are corrupted, to produce a reliability S for the error pattern symbols b(e) as

$$S = s(1) + s(2) + \ldots + s(e)$$

where s(j) is the reliability for a location associated with the bit b(j).

The error pattern reliability output S is compared at 42 to a reliability threshold in order to determine whether the output of a hard decoder 32 can be accepted as the output of the decoder 30 or whether a soft decision decoding process 44 should be invoked to provide the output from the decoder 30.

As can be seen, Weng compares the reliability S to a threshold, but does compare a received signal value to a threshold.

The Examiner points to column 3, lines 12-18 and lines 44-48 as well as to column 2, lines 65-67.

These portions of Weng state that the number of b(j) terms are counted, the count is used to select a reliability threshold, and this reliability threshold is determined by a reliability threshold processor 38 that operates on the reliability inputs r(j) to produce the threshold. If the reliability measure S is less than or equal to this threshold, the hard decoding pattern is accepted as the final decoder pattern. Otherwise, a soft decision decoding algorithm is invoked to produce

the final decoded error pattern. The corrupted code words c(j) have associated therewith the corresponding reliabilities r(j) which are generated by a channel processor (not shown).

The reliabilities r(j) are not generated based upon a comparison of a decoder signal value to a threshold. Indeed, Weng provides no disclosure of how the reliabilities r(j) are generated.

The reliability S is not generated based upon a comparison of a decoder signal value to a threshold. The reliability S is the sum of those reliabilities r(j) that correspond to the ones in the bit error pattern b(e).

In section 5 of the Office Action, the Examiner has failed to refute applicants' arguments.

Accordingly, because both Gosse and Weng fail to disclose generating a reliability factor based upon a comparison of the one received signal value to a threshold, Gosse and Weng would not have led the person of ordinary skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng.

In section 12 of the Office Action, the Examiner rejected claim 67 under 35 U.S.C. §103(a) as

being unpatentable over Gosse in view of Weng and further in view of Khayrallah.

However, Khayrallah fails to make up for the deficiencies of Gosse and Weng. Therefore, Gosse, Weng, and Khayrallah would not have led the person of ordinary skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Khayrallah.

Because independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Khayrallah, dependent claim 67 *per force* is not unpatentable over Gosse in view of Weng and further in view of Khayrallah

In section 13 of the Office Action, the Examiner rejected claims 68-70 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Weng and further in view of Webster.

However, Webster fails to make up for the deficiencies of Gosse and Weng. Therefore, Gosse, Weng, and Webster would not have led the person of ordinary skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Webster.

Because independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Webster, dependent claims 68-70 *per force* are not unpatentable over Gosse in view of Weng and further in view of Webster

<u>In section 14 of the Office Action</u>, the Examiner rejected claims 73 and 79 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Xu.

As discussed above, Gosse fails to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding.

Xu is no different from Brink or Chung and, therefore, likewise fails to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding.

Because Gosse and Xu fail to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding,

Gosse and Xu would not have led the person of ordinary skill in the art to the inventions of independent claims 73 and 79.

For this reason also, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu.

In section 15 of the Office Action, the Examiner rejected claims 75, 77, 81, and 83 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Xu and further in view of Webster.

However, Webster fails to make up for the deficiencies of Gosse and Xu. Therefore, Gosse, Xu, and Webster would not have led the person of ordinary skill in the art to the inventions of independent claims 73 and 79.

For this reason, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Webster.

Because independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Webster, dependent claims 75, 77, 81, and 83 *per force* are not unpatentable over Gosse in view of Xu and further in view of Webster.

In section 16 of the Office Action, the Examiner rejected claims 74, 76, 80, and 82 under 35

U.S.C. §103(a) as being unpatentable over Gosse in view of Xu and further in view of Kayrallah.

However, Kayrallah fails to make up for the deficiencies of Gosse and Xu. Therefore, Gosse, Xu, and Kayrallah would not have led the person of ordinary skill in the art to the inventions of independent claims 73 and 79.

For this reason, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Kayrallah.

Because independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Kayrallah, dependent claims 74, 76, 80, and 82 *per force* are not unpatentable over Gosse in view of Xu and further in view of Kayrallah.

CONCLUSION

In view of the above, allowance of all claims and issuance of the above captioned patent application are respectfully requested.

The Commissioner is hereby authorized to charge any additional fees that may be required, or to credit any overpayment, to account No. 260175.

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